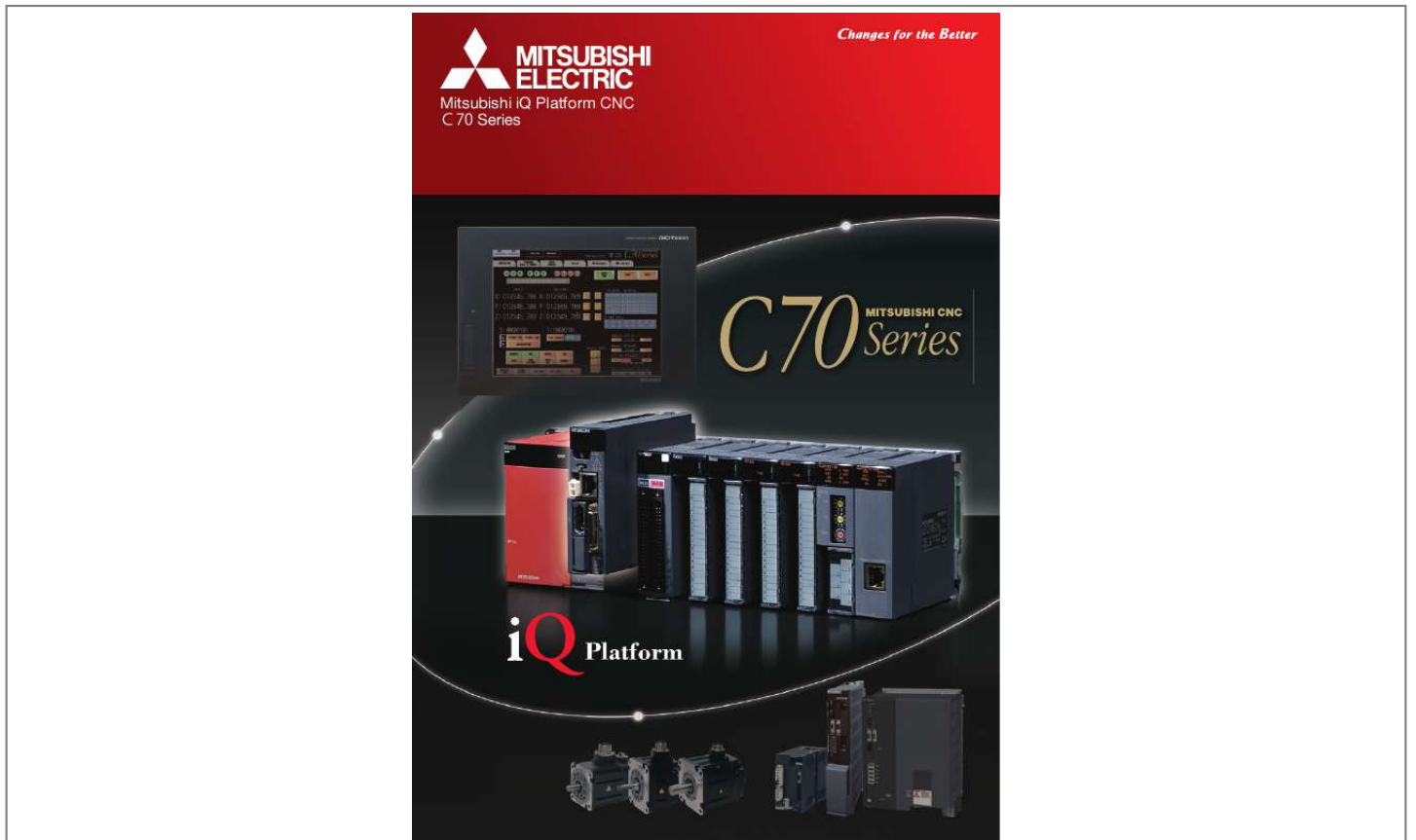




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Manual abstract:

@@@ Enables construction of a flexible system P13 P13 P14 Safety and Energy-savings Conformity with safety standards Energy-savings Aiming for no accidents/defects, Environmental protection Highly reliable safety observation function which conforms to the European safety standard EN954-1 Safety Category 3. High-efficiency spindle motor, servo motor and drive unit help realize energy-savings. Maximization of productivity with the FA expertise developed by Mitsubishi Electric. P15 Safety and Energy saving P16 C o n t i n u i t y provides the services matching users' life cycle. Maximization of productivity P16 C70 system configuration Case study Software Tools P5 P17 P19 List of Components Specifications P21 P23 * This catalog contains optional specifications. Please refer to the list of functional specifications and the specification manual for details. 1 2 High-performance controllers enable optimization of diverse production processes on shop floors. (production site) Manufacturing technologies iQ Platform is the next-generation integration platform. iQ stands for "integrated Q", "improved Quality", "intelligent & Quick" and "innovation & Quest". ERP Enterprise Resource Planning Mitsubishi FA integration solution iQ Platform enables construction of optimal systems for diverse lines.

Application example) Automobile production line MES Operation management Manufacturing Execution System Maintenance Production site Engine machining line Engine assembly line Welding line Vehicle body assembly line Controller & HMI Engineering environment Mitsubishi FA integration concept Network PLC CNC HMI CNC Servo Drive CNC Spindle Drive PLC Motion Controller HMI Servo Drive PLC HMI Servo Drive PLC HMI Servo Drive Design and Development Mitsubishi Electric helps optimize customers' production lines with the iQ Platform. Safety and Energy saving Main base module between multiple CPUs GOT1000 (Display) iQ Platform-compatible engineering environment. GOT drawing software PLC programming software Motion controller programming software Data exchanged seamlessly between software Design information shared among development phases Andon Manufacturing/Quality server Database Information network/ Ethernet Network among controllers/ CC-Link IE MELSECNET/H etc. PLC CPU CNC CNC PLC CNC CPU(C70) Motion controller CPU Robot CPU Controller network module (CC-Link IE) iQ Platform iQ Platform-compatible controller Add control functions by inserting into slots. System management tool Field network/ CC-Link Field network/ CC-Link Design information shared between software Design information DB Power supply module MELSEC-Q module Various I/O modules System designing Programming Test/Setup Operation/Maintenance Machine tool Machine tool Field network/ CC-Link Conveyer 3 4 C70 system configuration A compact module equipped with CNC functions that can control up to 7 part systems and 16 axes.

Manufacturing technologies (production site) CNC CPU(Q173NCCPU) Up to two CNC CPU modules can be mounted. I/O, network GX Developer Display configurations Machine operation screen*2 CNC monitor screen*3 Maintenance Drive system*1 Design and Development Drive unit (MDS-D/DH Series) Drive unit (MDS-D-SVJ3/SPJ3 Series) Optical network Servo motor Spindle motor Servo motor Spindle motor *2: Screen made by a user GOT1000 Series *3: Available on 8.4-type and larger models with SVGA or higher resolution. Drive unit (MDS-DM Series) Safety and Energy saving Manual pulse generator Servo motor Spindle motor GT Designer2 *1: Prepare drive system components which are for use with CNCs only. For CNCs only Sensor 5 6 Manufacturing technologies (production site) Enhanced productivity High-speed control shortens tact time.

(production site) Manufacturing technologies Speed enhancement by high-speed bus between multi-CPU's Ultrahigh-speed network between CNC CPUs and PLC CPUs For data transfer between CNC CPUs and PLC CPUs, we have newly developed dedicated a high-speed bus. Data is transferred at a high-speed cycle (0.88ms) between the CPUs' high-speed shared memories, so each CPU's speed can be fully utilized. Speed enhancement by CNC functions

Programmable in-position When commanding positioning (G00) and linear interpolation (G01), the in-position widths can be respectively specified in a machining program. This enables designation of the optimal in-position width for each machining pattern, thereby allowing tact time to be reduced. G00/G01 independent in-position check The in-position width for positioning (G00) can be set independently of the width for linear interpolation (G01). For example, you can shorten the positioning time while maintaining the depth accuracy by setting the G01's width smaller and G00's width larger. Maintenance Program example G00 Y100. , I0.2 G00 X100.

; Y ; 100 0.2 * Tool path X/Y : Positioning coordinates for each axis , I : In-position width (Command range : 0 to 99999.999mm) Effect of G00/G01 independent in-position check Without 100 X PLC CPU High-speed shared memory between CPUs Shared memory CNC CPU High-speed shared memory between CPUs Shared memory CNC CPU High-speed shared memory between CPUs Shared memory I/O network Shared memory Shared memory With 7.8 sec (3.5%) reduction In-position width G00:200µm G01:50µm The in-position widths can be set for each block. MELSEC Q bus High-speed bus between multiple CPUs Data is transferred at a high-speed cycle (0.88ms) between the CPUs' high-speed shared memories. Design and Development Workpiece: Cylinder head Connection with host system using e-F@ctory Effects of high-speed PLC CPUs, high-speed CNC CPUs and high-speed bus among the CPUs Drastically shortens machining cycle time. Versatile network modules allow connection with the host information system. A wide variety of Mitsubishi PLC MELSEC Q Series' network modules can be used.

<Outlined data flow when functions (M, S and T instructions) are performed by CNC together with PLC> CNC Machining program Execute the next block G0 X10 M10: G0 X20: PLC PLC program M10 X600 [Y500] [FIN] Q bus I/O Y500 Valve, etc. Controller Network (Network among controllers) ITM Network (Production/Quality information network) Safety and Energy saving Ethernet MES I/F(SQL) Data Base Plant/Line control CC-Link IE CC-Link, etc. High-speed block processing High-speed bus between CPUs High-speed PLC processing A contact to confirm completion of an instruction, etc. Synchronous (interlock) communication High-speed bus transfer cycle < PLC scan time High-speed bus transfer cycle < Block processing cycle Comparison of M-code execution time C64 (Conventional CNC) C70 In this graph, the C70 execution time is the base value, 1.



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Field Network (Intra-machine network) CC-Link/LT, etc.

Less wiring 3 to 5 times faster 7 8 Manufacturing technologies (production site) Enhanced productivity High-speed control shortens tact time. Stable productivity through automation (production site) Manufacturing technologies Speed enhancement with drive system functions Servo control Basic performance has been significantly enhanced by combining the world's top-level highly responsive current control (High-gain control) and a high-accuracy servo motor. Tool life management Spindle control This function counts accumulated time and frequency of tool use and monitors usage state of tools (Tool life management I). The spare tool selection function is available in "Tool life management II". Fixed cycle This function enables drilling, tapping, boring and other hole machining to be assigned by a patterned cycle.

This allows easy programming of the same machining simply by inputting the required data. In addition to the world's top-level, high-responsive current control, lost motion compensation and an adaptive-type resonance suppression filter, etc. are installed. These can realize reduced machining time, elimination of machine vibration and enhanced machining accuracy. The connection with the detector is high-speed and highly reliable serial communication. [Cutting]

[Tool function command] Counts time Checks the tool life and frequency of when the tool is tool use. selected. Tool life is over Z Y 40 110 20 150 10 40 Maintenance Drive unit MDS-D/DH X High-speed optical servo network C70 Drive unit MDS-D/DH High-gain control High-speed and high-accuracy servo motor In this graph, the conventional model's performance is the base value, 1. High-speed optical servo network Position control Speed control Various compensation functions Current control [Warning] Tool life over [Tool life management screen] # number highlighted PLC Comparison of control performance Current control Conventional MDS-D/DH Speed control Position control Conventional MDS-D/DH Conventional MDS-D/DH C70 Spindle motor Detector (serial connection) 5 times 2 times 2 times Enhanced performance Tool life register Tool length measurement Tool radius compensation This function automatically calculates the difference between the coordinate value of the commanded measurement position and the value where the tool actually reaches to the sensor, and then determines the tool compensation amount. If the tool has been already compensated, the compensation amount is adjusted as needed.

40 H52=100 210 Position control Speed control Current control Table [Preparation] Sets tool's life time and usage frequency. With fixed cycle, you can program these machining patterns easily. 10 20 20 20 110 20 20 T12 H12 Design and Development OMR-DD control (high-speed synchronous tapping) The servo axis detects and compensates the spindle's delay directly on the high-speed optical network to minimize the synchronization error. This control can reduce machining time by 25% compared to previous models with the same degree of accuracy. Effects of spindle's continuous position loop control <Reduction in orientation time> Under MDS-D/DH Series spindle control, position loop control is constantly maintained. Thus, controlling with the maximum torque is always possible with no need for position control switching. As deceleration can be performed with the maximum torque without being affected by load inertia, the spindle's orientation time has been reduced by 20%. This function corrects the actual tool center path inward or outward from the programmed path by the tool's radius amount. Tool path r r Tool exchange position Reference position (when identical to the machine coordinate's zero point) r: Tool radius compensation amount Programmed path Tool Safety and Energy saving High-speed optical servo network High-speed optical servo network Travndle motor Information on spindle motor temperature Ground fault detection for each motor Easy to specify the faulty axis Ground fault detection, which was formerly performed all at a time by a power supply unit, has changed so that the fault can be detected per motor. As detecting a faulty axis is possible, restore time will be shorter.

Power module [Emergency stop cancellation] Reduction of maintenance cost through efficient parts replacement Common maintenance parts Maintenance parts are the same as for MELSEC, thus possible to use the same parts. The main base, power supply and extension base are the same as those used for MELSEC, thus MELSEC Q Series' versatile I/Os and instrumentation modules are available. Possible to cut maintenance cost by using the same parts as MELSEC. Batch back-up/Batch restore function Simply replace the CF card in case of troubles By operating on the GOT, batch back-up and restore of data in GOT's CF card is possible. Data necessary for back-up is automatically determined.

Back-up into USB memory is available for GT16. By using the CF card extension slot on the cabinet front, possible to insert/remove the CF card without opening the cabinet. CF card slot GOT1000 Series Standard drive A Design and Development Ground-fault current Optimal current C70 control Built-in thermistor Detection of current value using a special switching circuit Ground fault C70 GOT1000 Series display C70 Detection of the stop of radiator fin cooling fan Allows systematic fan replacement Monitors cooling fan's rotation, and detects "Fan stop warning" that is output when the fan stops rotating. Previously, the motor was stopped in the event of fan stop by the module overheat alarm. With this "Fan stop warning"; however, the fan can be replaced systematically without stopping the motor.

To CNC Fan stop warning Conventional Fan stops Module temperature rises MDS-D/DH Fan stops Fan stop warning occurs Motor keeps running Preparation for fan (unit) replacement Replacement of fan (unit) Maintenance parts in common Option drive B (Front installation type) Safety and Energy saving [PLC data] [NC data] ·Sequence program ·Parameter ·Machining program ·Parameter ·Tool data, etc. Maintenance parts in common Use of connector on motor's power line Allows for easier wiring By using a connector on motor's power line, wiring workability has improved. (Product lines applied) MDS-D Series (200V): Servo: 4.5kW and smaller, Standard spindle: 5.5kW and smaller MDS-DH Series (400V): Servo: 7.0kW and smaller, Standard spindle: 7.5kW and smaller [When attached] [When detached] Main base Input/Output module Power supply module Extension base Various MELSEC modules Cooling fan stop detection function added Overheat alarm occurs Motor stops 11 12 Design and Development Shortened design and development period Streamlined design and development through subdivision and structuring of programs PLC CPU module with large memory capacity Large-capacity CPUs have been added to C70's PLC CPU lines.



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Program capacity has been widely extended, and standard ROM capacity has also been extended up to 4MB. Flexible system configurations (production site) Manufacturing technologies Facilitates subdivision and structuring of sequence programs Enables configuring the system optimal for your system Building block type enables the optimum hardware configuration. Only one fixing screw is used at the upper part of the base board, and modules are fixed to the base board by connectors.

Due to its compact size, replacement of the module is easy, which allows efficient maintenance works. An independent PLC CPU allows suitable selection of a PLC CPU for your system's size and purpose. PLC CPU and each I/O unit, and intelligent units are connected via Q bus; thus, conventionally used power supply, I/O and network modules for MELSEC Q Series can be used. The number of sequence programs has been extended up to 124 to enable the precise management of programs according to product or process, etc. By subdividing and structuring sequence programs, the visibility and availability of programs are enhanced. Large-capacity type added Model name (Ethernet built-in type) Program capacity Standard ROM capacity (Flash ROM) Q03UDCPU (Q03UDECPU) 30k steps Q04UDHCPU (Q04UDEHCPU) 40k steps Q06UDHCPU (Q06UDEHCPU) 60k steps Q13UDHCPU (Q13UDEHCPU) 130k steps Q26UDHCPU (Q26UDEHCPU) 260k steps Subdivision and structured management of PLC programs Program for Product B Process 2 Program for Product A Program for Product A Process 2 Program for Product A Process 1 Program for Product B Process N Program for Product B Process 2 Program for Product B Process 1 Program for Product A Process N CNC CPU PLC CPU Up to two CNC CPU modules can be mounted. Motion CPU Robot CPU Maintenance 1MB 2MB 4MB Common program Up to 124 programs * When necessary to comply with the safety standard, use the conventional CPU (Q03UDCPU/Q04UDHCPU/Q06UDHCPU). Only one fixing screw used at upper part I/O, Network Power supply 100 to 240VAC 24VDC Base Machine operation panel computerized and aggregated GOT screen drawing tool (GT Designer2) enables simple custom screen development. Possible to operate machine with the touch panel screen, instead of the conventional machine operation panel. Q bus Building block type CNC monitor installed CNC monitor has been installed, which allows editing of machining programs and setting each CNC data.

The CNC monitor can be used simply by installing from GT Designer2; thus no need to develop screen. The CNC monitor screen can be displayed by connecting to the CNC CPU's DISPLAY interface via Ethernet or by connecting to the main base via bus. The CNC monitor requires an 8.4-type or larger GOT with SVGA or XGA resolution. CNC CPU function expanded Design and Development (macro interface function extended) Possible to define up to 1200 sets of variables, which are able to write/read from a PLC CPU.

These variable sets can be handled as system variables in the machining program. To enable access from a PLC CPU, the area for the variables is allocated in a CNC CPU. Write/Read is performed using special instructions. This function is useful when a large number of variable sets are needed, such as for a grinder. QnUD(H)CPU PLC program ATC special instruction (magazine control) As ATC (Automatic Tool Changer) is difficult to control only with basic and functional instructions, dedicated instructions for ATC control is available.

The following instructions are available as ATC special instruction, such as magazine indexing control and replacement with arm, etc. · Search tool number · Exchange tools · Forward/Reverse rotation of tool table · Forward/Reverse pointer (indicates the magazine's indexing position) · Read/Write tool data, etc. Conventional machine operation panel C70 ZR device NC machining program Safety and Energy saving GOT (touch panel) Allows editing of C70's ladder program on a GOT GOT's "Ladder edit function" enables editing of C70 sequence programs in ladder format from a GOT. The ladder's operation condition can also be monitored on the GOT. D(P).DDWR instruction D(P).DDR instruction Indexing position Extended macro interface for system variables Decelerator PLC axis control Servo motor An independent axis control by PLC is possible, apart from NC control axes. PLC axis control is useful for controlling the axis not involved in machining such as tool magazine and pallet changer. Indexing control with magazine axis 13 14 Safety and Energy-savings Aiming for no accidents/defects, Environmental protection Highly reliable safety observation function which conforms to the European safety standard EN954-1 Safety Category 3. Safety observation function Safety signal comparison (duplex safety circuit) PLC CPU and CNC CPU observe the consistency of safety signals input/output in two systems.

User's safety sequence is executed by both PLC CPU and CNC CPU. If a safety signal comparison error occurs, emergency stop will activate to shutdown power to the drive system. PLC CPU CNC CPU Dual signal module PLC CPU Machine sequence User's safety sequence Energy-savings with a high-efficiency spindle motor, servo motor and drive unit Manufacturing technologies (production site) Drive unit (MDS-D/DH Series, MDS-DM Series) Emergency stop duplexing Safety signal is input/output by 2 systems. Each CPU shuts down power in the event of an error. Door signal is input into the drive unit (speed monitoring by each door is possible). PLC CPU CNC CPU Dual signal module Spindle motors/Servo motors Energy loss of spindle motors during high-speed operation has been substantially reduced. Drive current of servo motors has also been reduced by downsizing the motors while increasing the torque. Spindle motor Energy loss during continuous rated load operation When rated output is 17.6kW at 15,000 rpm 5 Energy loss [kW] 4 3 5.2 2 1 0 Conventional spindle motor 3.

2 Application of the power regeneration system which allows energy generated during deceleration to be efficiently used as a power supply. Use of low-loss power devices enables reductions in loss of power. Energy flow when motor is decelerating When motor is decelerating, energy in the motor is fed back to the power supply. MDS-D/DH-CV Converter circuit 6 MDS-D/DH-Vx MDS-D/DH-SPx Inverter circuit CNC CPU CNC-side comparison error signal User's safety sequence Reduced by 56% Maintenance GX Developer CNC-side input/output signals PLC-side comparison error signal Comparison with Comparison with CNC-side signal PLC-side PLC-side signal input/output signals 3-phase AC power supply Emergency stop signal input (24V input) PLC CPU-side safety signal terminal block CNC CPU-side safety signal terminal block Door 1 Door 2 Light curtain Regeneration inverter circuit Spindle motor Servo motor Energy flow during deceleration Terminal block Safety signal Dual signal module (Q173SXY) Safety signal PLC-side safety output signal CNC-side safety output signal Drive unit Power shutdown Current High-efficiency spindle motor Motor current Servo motor Current at stall torque Rated output: 2.



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0kW Time 3-phase AC power supply Speed observation function CNC CPU and Drive unit CPU observe to see if motor's command speed and feedback speed exceed the safe speed when the machine's protection door is open.

If an exceeding speed is detected, it causes emergency stop to shut off the drive system power. Possible to enable/disable speed observation for the axes for each door (up to 16 doors). CNC CPU CNC CPU Speed observation Feedback speed monitoring Command speed monitoring Speed Motor speed (Arms) Reduced by 40% 22.4 13.4 Design and Development Time Dual signal module specification (Q173SXY) Signals are connected to 20 input points and 12 output points in 2 systems.

Up to 3 modules can be mounted. PLC CPU CNC CPU Dual signal module Input Output Point 20 1 11 Signal description Safety signal for user Power shutdown signal Safety signal for user Conventional series New series Drive unit CPU Speed feedback Speed observation Feedback speed monitoring Command speed monitoring Servo control Productivity maximization with the FA expertise developed by Mitsubishi Electric. Mitsubishi Factory Automation Solutions We provide best suited systems for users from our accumulated Factory Automation expertise and experience. We support from lower to upper components and networks required in manufacturing, as well as the applications needed for control. Information technologies Production management Facility maintenance Quality control Machining network system CAD/CAM system Production management system Door Drive unit Door signal is input to the drive unit and dual signal module. Q bus Position/Speed command Motor driving current PLC-side safety signal CNC-side safety signal * Power shutdown signal ...turns ON when Ready-ON is possible and when there is no signal comparison error. * All output signals of the 2nd and 3rd modules can be used as safety signals for the user.

Optimization Waste eliminated Safety and Energy saving MELQIC inspection module MES interface Motor detector Dedicated I/O network Mechatronics technologies Other safety related functions Edit lock (program protect) The edit lock function inhibits machining program B or C (group with machining program numbers) from being edited or erased to protect the programs. Control technologies Electron beam machine Laser EDM Higher performance Machining time reduced Stored stroke limit Set the tool's prohibited area to avoid collision. PLC Motion controller Robot Door interlock European Safety Standards CE Marking (machine directive) prohibits machine protection door from being opened during axis traveling. Door interlock function decelerates and stops all the control axes when door open signal is input from PLC, and then performs Ready OFF to shut down the driving power inside the servo drive unit to disable the motor driving. Distribution technologies Drive technologies Operator authentication (GOT) The operation and browse level (authority) can be set for each operator by password to "strengthen security" and "prevent operation mistakes". Power measuring Energy measuring module module MDU Electric type circuit breaker indicator Higher efficiency Energy saved AC servo Inverter Robot Mitsubishi FA product groups 15 16 Case Study Case Study (production site) Manufacturing technologies One CNC can control up to 7 part systems and 16 axes. Up to two CNC modules can be mounted. This can be applied to from multi-axis lathe and machining center to multi-axis and multi-part system transfer machine. Compound lathe (two spindles and two turrets, equipped with workpiece conveying robot) One CNC CPU can control both the 2-part system lathe turning and transfer loader control. Possible to control both synchronization and separate operations between the right and left sides.

Transfer machine One CNC CPU can control up to 16 axes and 7 part systems. Thus, one C70 module can control an entire small-size transfer machine. helps downsizing and less wiring of control panel. This contributes to the reduction of cycle time. Also the machine development environment can be unified (GX Developer, GT Designer etc.

). · Number of part systems: 3 · Number of NC axes: 6 · Number of spindles: 2 Maintenance One CNC CPU can control up to 16 axes of servo axes and spindles. Compound lathe (with milling function) Design and Development One CNC CPU can control both the 2-part system lathe turning and milling. Processing robot cell · · · Number Number Number Number of of of of part systems: 2 NC axes: 4 spindles: 2 PLC axes: 2 One PLC CPU plus up to three other CPUs (CNC, robot and motion controller) can be mounted on a single base. helps downsizing and less wiring of control panel.

Linkage among CPUs is improved (high-speed bus connection). helps reduce cycle time. Machine tool PLC CPU: controls peripheral device CNC CPU: controls machine tool Robot CPU: controls robot Safety and Energy saving Machining center (horizontal) One CNC CPU can control both milling and auxiliary control such as tool magazine and ATC arm. Tool magazine Spindle Y A X Z B · · · · Number Number Number Number of of of of part systems: 1 NC axes: 5 spindles: 1 PLC axes: 3 ATC arm 17 18 Software Tools Software tools supporting CNC operation and development environments Manufacturing technologies (production site) Remote Monitor Tool An identical screen with CNC display can be displayed on a personal computer. By connecting a PC to a CNC module when necessary, various data can be checked and set on the same Human Machine Interface (HMI) as the standard NC screen. This tool can be downloaded from MELFANSweb free of charge. MS Configurator/servo adjustment support tool Servo parameters can be automatically adjusted by activating the motor with machining programs for adjustment or vibration signals, and measuring/analyzing the machine characteristics. This tool can be downloaded from MELFANSweb free of charge. GT Designer 2 Version2/screen design support tool Screen design software with many user-oriented functions, making custom screen creation easy. Drawing screen (editor) Efficient screen creation, even when there are many screens <Main functions> Bode diagram measurement display Speed loop gain adjustment Position loop gain adjustment Notch filter setting Acceleration/Deceleration time constant adjustment Circularity adjustment Ethernet Workspace An intuitive tree display makes copying, deleting, and component registration easy Tool bar Icon display improves work efficiency Data list Batch conversion Conversion of multiple objects and figures at the same time Easy to select overlapped figures Ethernet Library editor Dedicated component editing screen Maintenance C70 Remote Monitor Tool Servo waveform measurement MS Configurator C70 Library image list Image display of registered components Temporary area Smoother screen design GX Developer/sequence programming tool The MELSEC programming tool, offering a wide array of functions and easy use, allows for convenient program design and debugging.



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Linking with a simulator or other utility allows for the efficient programming. NC Configurator/ CNC parameter set-up support tool CNC data necessary for CNC control and machine operation (such as parameters, tool data and common variables) can be edited on a personal computer. The edited data can be then transferred to the CNC. Property sheet List display of object & figure attributes Dialog box To jump to the relevant object, double-click or use the jump button. <Example of device list> Device list / Character strings list Device search jump for increasing work efficiency Design and Development Ethernet USB cable Ethernet USB cable GT SoftGOT1000 Version2 (supported by GOT1000) / HMI software C70 GX Developer C70 NC Configurator Screen data created by GT Designer2 Version2 can be used without conversion. GT SoftGOT1000 is an HMI software which offers GOT1000 functions on personal computers and panel computers. Remote monitoring over the factory LAN Better linkage with other applications and more flexibility when creating screens Monitor for Line 2 Servo selection tool By selecting the machine configuration model and inputting the machine specifications, the optimal servo motor that meets the specification can be selected. Other selection functions which totally support the drive system selection are also available. This tool can be downloaded from MELFANSweb free of charge. Conditions at the production sites can be monitored from a remote location.

Monitor for Line 1 Multiple instances of GT SoftGOT1000 can run on a single personal computer. Upon the occurrence of problems, the status of on-site equipment can be quickly monitored from your office. This reduces the time for initial diagnosis. Internal device interface functions: Using these functions, user-created applications can read/write data from/to the GOT internal devices. It is possible to construct advanced systems by linking data to user applications such as a data logger.

Safety and Energy saving <Development environment of user applications> Monitor for Line 3 Monitor for Line 4 <Main functions> Servo motor capacity selection, regenerative resistor capacity selection, spindle acceleration/deceleration time calculation, power supply capacity selection, power supply facility capacity calculation, etc. Microsoft®Visual C++ .NET2003, Microsoft®Visual C++(Version.6.0), Microsoft®Visual Basic.

NET2003, Microsoft®Visual Basic(Version.6.0) Office Worksite Ethernet Personal computer Personal computer Startup of other applications: In full-screen mode, other applications can be started with touch switches on the monitor screen of the GT SoftGOT1000. Production site Connection with MELSEC instrumentation GT SoftGOT1000 and PX Developer monitoring tools can be connected to easily establish an instrumentation monitoring system. Line 1 When you select the machine model and input specifications, the selection result of the motor will be displayed. The result can be output in PDF format. Line 2 Line 3 Line 4 19 20 List of Components (production site) Manufacturing technologies CNC related module CNC CPU module Product name CNC control module Model name Remarks MELSEC related module Main base Product name Main base Model name Q38DB Q312DB Remarks 8 slots 12 slots Q173NCCPU-S01 Battery set MITSUBISHI CNC C70 One each of the battery holder unit with a battery unit connection cable (0.5m) (Q170DBATC or Q173NCBATC), and battery (Q6BAT) Cable for CNC CPU Cable model name PLC CPU module Product name Purpose Max. length Standard length (m) Remarks Model name Q03UDCPU Q04UDHCPU Q06UDHCPU Q13UDHCPU Q26UDHCPU Q03UDECPU Q04UDEHCPU Q06UDEHCPU Q13UDEHCPU Q26UDEHCPU Remarks Program capacity: 30k steps Program capacity: 40k steps Program capacity: 60k steps Program capacity: 130k steps (Note 1) Program capacity: 260k steps (Note 1) Built-in Ethernet, Program capacity: 30k steps (Note 1) Built-in Ethernet, Program capacity: 40k steps (Note 1) Built-in Ethernet, Program capacity: 60k steps (Note 1) Built-in Ethernet, Program capacity: 130k steps (Note 1) Built-in Ethernet, Program capacity: 260k steps (Note 1) F020 F021 G020 G021 G380 G395 G396 H010 H100 H200 H300 H310 H400 H500 Manual pulse generator : 1ch Manual pulse generator : 2ch Manual pulse generator : 1ch Manual pulse generator : 2ch Optical servo communication Optical servo communication Optical servo communication For connection with signal splitter Emergency stop Connection with display SKIP/MPG input SKIP signal connection 1ch manual pulse generator 5V Dual signal module connection 45m 45m 15m 15m 20m 10m 10m 5m 30m 20m 20m 15m 20m 0.5m 0.

5, 1, 2, 3, 5, 7, 10, 15, 20 0.5, 1, 2, 3, 5, 7, 10, 15, 20 0.5, 1, 2, 3, 5, 7, 10, 15 13, 15, 20 1, 2, 3, 5, 10 0.3, 0.5, 1, 2, 3, 5 0.5, 1, 2, 3, 5 0.5, 1, 2, 3, 5, 7, 10, 15, 20 1, 2, 3, 5, 10, 15, 20 0.5, 1, 2, 3, 5, 7, 10, 15, 20 0.5, 1, 2, 3, 5, 7, 10, 15 0.5, 1, 2, 3, 5, 7, 10, 15 0.

5, 1, 2, 3, 5, 7, 10, 15, 20 0.1, 0.2, 0.3, 0.5 12V power supply is available.

For connection with signal splitter 5V power supply is available. For connection with signal splitter PCF-type with reinforced sheath for wiring outside the panel POF-type with reinforced sheath for wiring outside the panel POF-type without reinforced sheath for wiring inside the panel UTP cable for wiring in panel. For wiring outside of panel, prepare the STP cable separately. PLC CPU Maintenance (Note 1) Unavailable when safety function is selected. For signal splitter connection Basic power supply module Product name Power supply Q61P Q63P Q64P Model name Remarks Input voltage: 100 to 240VAC, output voltage: 5VDC, output current: 6A (Note 1) Input voltage: 24VDC, output voltage: 5VDC, output current: 6A Input voltage range: 100 to 120VAC/200 to 240VAC, output voltage: 5VDC, output current: 8.

5A Dual signal module Product name Dual signal module Terminal block Model name Remarks (Note 1) Unavailable when safety function is selected. Q173SXY Q173SXY-2 FA-LTB40P FA-CBL FMV-M Cable IO redundant monitoring unit (up to three units) IO redundant monitoring unit (high-speed model) (up to three units) Terminal block conversion unit (purchase from Mitsubishi Electric Engineering) Terminal block conversion unit connection cable (length = 05: 0.5m, 10: 1m, 20: 2m, 30: 3m, 50: 5m) (Purchase this from Mitsubishi Electric Engineering) For other related units, please contact us. Design and Development Peripheral unit Product name Signal splitter Manual pulse generator Manual pulse generator Model name Remarks FCU7-HN387 UFO-01-2Z9 HD60 Options (necessary for 2 or 3-axis manual pulse generator) 5V specification 12V specification, for connecting to signal splitter, need to prepare 12V power supply. Drive unit Series name Remarks GOT related unit GT16 model Product name Model name Remarks MDS-D/DH Series MDS-DM Series MDS-D-SVJ3/SPJ3 Series Power regeneration type Multi-axis integrated, power regeneration type Resistor regeneration type Safety and Energy saving GT1695M-XTBA GT1695M 15.



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0" XGA [1024x768 dots] TFT color LCD (high-brightness, wide viewing angle) 65,536 colors <Multimedia and video/RGB supported>100-240VAC, Built-in flash memory 15MB 15.0" XGA [1024x768 dots] TFT color LCD (high-brightness, wide viewing angle) 65,536 colors <Multimedia and video/RGB supported>24VDC, Built-in flash memory 15MB 12.1" SVGA [800x600 dots] TFT color LCD (high-brightness, wide viewing angle) 65,536 colors <Multimedia and video/RGB supported>100-240VAC, Built-in flash memory 15MB 12.1" SVGA [800x600 dots] TFT color LCD (high-brightness, wide viewing angle) 65,536 colors <Multimedia and video/RGB supported>24VDC, Built-in flash memory 15MB 10.4" SVGA [800x600 dots] TFT color LCD (high-brightness, wide viewing angle) 65,536 colors <Multimedia and video/RGB supported>100-240VAC, Built-in flash memory 15MB 10.

4" SVGA [800x600 dots] TFT color LCD (high-brightness, wide viewing angle) 65,536 colors <Multimedia and video/RGB supported>24VDC, Built-in flash memory 15MB 8.4" SVGA [800x600 dots] TFT color LCD (high-brightness, wide viewing angle) 65,536 colors <Multimedia and video/RGB supported>100-240VAC, Built-in flash memory 15MB 8.4" SVGA [800x600 dots] TFT color LCD (high-brightness, wide viewing angle) 65,536 colors <Multimedia and video/RGB supported>24VDC, Built-in flash memory 15MB Use Mitsubishi CNC's dedicated drive system (drive unit, servo motor and spindle motor). Other drive units, servo motors and spindle motors, which are not Mitsubishi CNC's dedicated products, such as Mitsubishi general-purpose AC servo drive, cannot be used. For the Mitsubishi CNC's dedicated drive system, please refer to "MITSUBISHI CNC DRIVE SYSTEM GENERAL CATALOG". GT1675M GT1685M GT1695M-XTBD GT1685M-STBA GT1685M-STBD GT1675M-STBA GT1675M-STBD GT1665M-STBA GT1665M GT1665M-STBD GT15 model is also available. (Note) CNC monitor is enabled on the 8.4-type or larger GOTs with SVGA or XGA resolution. For other related units, please contact us. For other related units, please contact us.

21 22 Specifications Installation environment conditions CNC CPU module Item Specification Outline drawings Manufacturing technologies (production site) CNC CPU module (Q173NCCPU) [mm] Main base/Extension base (1) (5) M4 x 4 (4) Operating ambient temperature Storage ambient temperature Operating ambient humidity Storage ambient humidity Vibration resistance 0 to 55°C 25 to 75°C (Note 3) 5 to 95%RH, non-condensing 5 to 95%RH, non-condensing Under intermittent vibration Frequency 10 to 57Hz 57 to 150Hz 10 to 57Hz Under continuous vibration 57 to 150Hz 147m/s², 3 times in each of 3 directions X, Y and Z No corrosive gases or inflammable gases 2000m (6561.68ft.) or lower Inside control panel II or less 2 or less Acceleration 9.8m/s² 4.9m/s² Amplitude 0.

075mm 0.035mm Sweep count 10 times each in X, Y and Z directions (80 min.) 98 (1) (2) (3) (4) (5) (6) (2) (7) (13) 7.5 WSI WS2 (3) WS3 Shock resistance Operating ambience Operating altitude Installation location Overvoltage category (Note 1) Pollution level (Note 2) W 119.3 (12) W WSI WS2 WS3 (8) (9) (10) (11) H HSI HS2 170±0.

3 138±0.3 170±0.3 249±0.3 Main base Q38DB 328 Q312D 439 Q63B 189 15.5 167±0.3 98 7 80±0.3 [mm] 222.5±0.3 190±0.3 116±0.

3 190±0.3 227±0.3 Extension base Q65B 245 Q68B 328 Q612B 439 Maintenance C70, which is open equipment, must be installed within a sealed metal control panel (IP54 or higher). C70 must also be used and stored under the conditions listed in the specifications table above. (Note 1) This indicate at which point this equipment is assumed to be connected between a public power distribution network and local machinery equipment. Category II applies to equipment for which electrical power is supplied from fixed facilities. The surge voltage withstand level for the rated voltage of up to 300V is 2500V. (Note 2) This index indicates the degree to which conductive material is generated in terms of the environment where the equipment is used. Pollution level 2 means that only non-conductive pollution can occur. However, a temporary conductivity may be caused by accidental condensing.

(Note 3) Do not use or store the C70 under pressure higher than the atmospheric pressure of altitude 0m. Doing so may cause an operation failure. (Note 4) The following environmental conditions are also required for the layout design. · No large amount of conductive dust, iron filings, oil mist, salt, or organic solvents · No direct sunlight · No strong electrical or magnetic fields · No direct vibrations or shocks to the C70 Part explanation (1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) LED: Display of state/alarm code (with 3 digits) SW1: Rotary switch for maintenance (usually set to "0") SW2: Rotary switch for maintenance (usually set to "0") SW: (Not used) EMG: Connector for the emergency stop signal input DISPLAY: Connector for display (GOT) CNI:

Connector for servo/spindle drive unit RIO: Connector for dual signal module Q173SXY AC FAIL: (Not used) MPG: Connector for manual pulse generator BAT: Connector for battery Service: Connector for MITSUBISHI's servicing (Do not use) EXT I/F: Connector for the expansion connection of skip signal/manual pulse generator Part explanation (1) (2) (3) (4) (5) Extension cable connector Base cover Module connector Module mounting screw hole Base mounting hole Design and Development Manual List of manuals The manuals relating to the C70 are listed below. All of the latest versions of the manuals can be downloaded from MELFANSweb.

Signal splitter 86 (Note) Signal splitter allows DIN rail installation only. [mm] Battery for CNC CPU (Q173NCCPU) 2-φ5.3 (M5x14) [mm] DIN Rail 45 Classification C70 Manual title C70 Specifications Manual C70 Connection Manual C70 PLC Interface Manual C70 Setup Manual C70 Instruction Manual C70 Programming Manual (Machining Center System) Manual No. IB-1500258 IB-1500260 IB-1500262 IB-1500264 IB-1500266 IB-1500268 IB-1500274 IB-1500874 IB-1500024 IB-1500890 IB-1500892 IB-1500157 IB-1500192 Model code 100-008 100-010 100-012 100-014 100-016 100-018 100-006 100-150 008-299 100-167 100-169 008-383 008-482 Contents Details of hardware and function specifications Installation and connection 33 80 7.5 172 60 Safety and Energy saving 45 Control signals necessary for creating sequence programs Set-up procedure and explanation of parameters and alarms Handling such as operation method and daily maintenance Programming with G codes (for machining center system) Programming with G codes (for lathe system) Specifications of power regeneration type units Handling of power regeneration type units Specifications of multi-axis integrated, power regeneration type units Handling of multi-axis integrated, power regeneration type units Specifications of resistor regeneration type units Handling of resistor regeneration type units Part explanation (1) (2) (3) (4) (5) (6) NC I/F: Connector for CNC CPU RIO1: (Not used) DCIN: Terminal block for power supply (to be used for the 12V manual pulse generator) SKIP: Connector for skip signal MPG: Connector for manual pulse generator TERMINAL: (Not used) (1) (2) (3) (4) (5) (6) RIO1 40 66 18.



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4 DIN Rail Drive system (servo/spindle) MDS-D/DH Series Specifications Manual MDS-D/DH Series Instruction Manual MDS-DM Series Specifications Manual MDS-DM Series Instruction Manual MDS-D-SVJ3/SPJ3 Series Specifications Manual MDS-D-SVJ3/SPJ3 Series Instruction Manual CNC CPU module model name Lifetime of battery Power-on time ratio*1 0% 30% 50% 70% 100% Guaranteed value*2 (75°C) 20,000hr 27,000hr 31,000hr 36,000hr 43,800hr Actual service value*3 (40°C) Back-up time after alarm*4 90hr (after SM51 or SM52 ON) Q173NCCPU 43,800hr 23 *1: The power-on time ratio indicates the ratio of C70 power-on time to one day (24 hours). (When the total power-on time is 12 hours and the total power-off time is 12 hours, the power-on time ratio is 50%.) *2: The guaranteed value is equivalent to the total power failure time which we have calculated based on the memory's (SRAM) characteristic value provided by the manufacturer under the storage ambient temperature range of -25 to 75°C (operating ambient temperature of 0 to 55°C). *3: The actual service value; equivalent to the total power failure time that is calculated based on the measured value under storage at ambient temperature of 40°C. This value is intended for reference only, as it varies with the characteristics of the memory, etc. *4: In the following status, the back-up time after power OFF is 3 minutes. · The battery connector is disconnected. · The battery lead wire is broken. 11.6 C70 Programming Manual (Lathe System) 30 24 Specification Functional Specifications Manufacturing technologies (production site) Standard Optional Selection Standard Optional Selection Class M system Number of basic control axes (NC axes) Max.

number of axes (NC axes + Spindles + PLC axes) Max. number of NC axes (in total for all the part systems) Control axes Max. number of spindles Max. number of PLC axes Number of simultaneous contouring control axes Control axes Max. number of NC axes in a part system Standard number of part systems Max. number of part systems C70 L system 2 16 16 4 7 4 8 1 7 3 General explanation Class M system C70 L system 1000 1000 General explanation 3 16 16 7 7 4 8 1 The NC axis, spindle, and PLC axis are generically called the control axis. The NC axis can be manually or automatically operated using the machining program. The PLC axis can be controlled using the sequence program. The number of axes that is within the max. number of control axes, and that does not exceed the max.

number given for the NC axis, spindle and PLC axis, can be used. Number of axes with which simultaneous interpolation control is possible. Rapid traverse rate (m/min) Cutting feed rate (m/min) Feed rate Manual feed rate (m/min) 1000 1000 The rapid traverse rate can be set independently for each axis using the parameters. This function specifies the feedrate of the cutting commands, and gives a command for a feed amount per spindle rotation or feed amount per minute. The manual feedrates are designated as the feedrate in jog mode or incremental feed mode for manual operation and the feedrate during dry run ON for automatic operation.

The manual feedrates are set using external signals. This function multiplies the rotary axis' command speed by ten during initial inching. By issuing a G command, the commands from the block are issued directly by the numerical value following F as the feedrate per minute (mm/min, inch/min). By issuing a G command, the commands from the block are issued directly by the numerical value following F as the feedrate per spindle revolution (mm/rev, inch/rev). The feedrate registered by parameter in advance can be assigned by designating a single digit following address F.

Override can be applied to manual or automatic rapid traverse using the external input signal supplied. Override can be applied to the feedrate command designated in the machining program using the external input signal supplied. Override can be further applied as a second-stage override to the feedrate after the cutting feed override has been applied. By turning ON the external override cancel signal, the override is automatically set to 100% for the cutting feed during automatic operation mode (memory and MDI). Acceleration/deceleration is applied to all commands automatically. The acceleration/deceleration patterns are linear acceleration/deceleration, soft acceleration/deceleration, exponent function acceleration/deceleration, exponent function acceleration/linear deceleration and any other that can be selected using a parameter. This function performs acceleration/deceleration at a constant inclination during linear acceleration/deceleration in rapid traverse mode. Compared to the method of acceleration/deceleration after interpolation, the constant inclination acceleration/deceleration method improves cycle time. Thread cutting with a designated lead can be performed. Inch threads are cut by designating the number of threads per inch with the E address.

By commanding the lead increment/decrement amount per thread rotation, variable lead thread cutting can be performed. 1000 1000 Rotary axis command speed tenfold Max. number of NC axes possible to control in the same part system. Feed per minute One part system is the standard. Up to three part systems for the lathe system, and up to seven part systems for the machining center system. The machining programs stored in the memory of the CNC module are run.

Rapid traverse override The MDI data stored in the memory of the CNC module is executed. Cutting feed override Possible to command in increments of 0.001mm (linear axis) and 0.001° (rotary axis).

Possible to command in increments of 0.0001mm (linear axis) and 0.0001° (rotary axis). The unit systems of the data handled in the controller include the metric system and inch system. The type can be designated with the parameters and machining program.

G code (program) format. G code list for the lathe system. The G-code list is selected by parameter. Feed Acceleration/ Deceleration Rapid traverse constant inclination acceleration/deceleration Thread cutting (Lead/Thread number designation) Variable lead thread cutting Synchronous tapping (with digital I/F spindle) Thread cutting Synchronous tapping cycle Pecking tapping cycle Chamfering High-speed synchronous tapping (OMR-DD) Manual rapid traverse Jog feed Manual feed Incremental feed Handle feed Dwell Dwell (Time-based designation) Memory capacity (number of programs stored) Memory capacity Program memory/ editing 15KB[40m] 30KB[80m] 60KB[160m] 125KB[320m] 230KB[600m] Program editing Editing Background editing (64 programs) (128 programs) (200 programs) (200 programs) (400 programs) Override 2nd cutting feed override Override cancel Control part system Feed rate input methods Feed per revolution F 1-digit feed Maintenance Control axes Memory mode and operation modes MDI mode Least command increment Data increment Least command increment 1µm Least command increment 0.



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1µm Unit system Inch/Metric changeover Program format Format 1 for Lathe Automatic acceleration/deceleration after interpolation Program format Input command Format 2 for Lathe Format 1 for Machining center Design and Development G code list for the machining center system.

For decimal point input type I, the minimum digit of a command not using a decimal point is the same as the least command increment. For Decimal point input type II, when there is no decimal point, the final digit serves as the millimeter unit in the metric mode, as the inch unit in the inch mode and as the second unit in the time designation. When axis coordinate data is issued in a machining program command, either the incremental command method that commands a relative distance from the current position or the absolute command method that moves to a designated position in a predetermined coordinate system can be selected. For the axis command value, the radius designation or diameter designation can be changed over with parameters. When the diameter designation is selected, the scale of the length of the selected axis is doubled. (Only half (1/2) of the command amount moves.) This function carries out positioning at high speed using a rapid traverse rate with the travel command value given in the program. The G code command always moves the tool to the final position in the direction determined by parameters. Linear interpolation is a function that moves a tool linearly by the travel command value supplied in the program at the cutting feedrate designated by the F code. This function moves a tool along a circular arc on the plane selected by the travel command value supplied in the program.

With this function, any two of three axes intersecting orthogonally are made to perform circular interpolation while the third axis performs linear interpolation in synchronization with the arc rotation. This control can be exercised to machine large-diameter screws or 3-dimensional cams. Using 1 linear axis and 1 rotary axis, this function composes a hypothetical linear axis which orthogonally intersects the real linear axis. Decimal point input I, II Command value Absolute/Incremental command This function performs tapping through synchronized control of the spindle and servo axis. This eliminates the need for floating taps and enables tapping to be conducted at a highly accurate tap depth. The load applied to the tool can be reduced by designating the depth of cut per pass and cutting the workpiece to the hole bottom for a multiple number of passes. Chamfering can be enabled during the thread cutting cycle by using external signals. This function increases the accuracy and shortens the cycle time of synchronous tapping by making the NC axis follow the spindle using drive unit communication. The tool can be moved at the rapid traverse rate for each axis separately. Override can also be applied to the rapid traverse rate by means of the rapid traverse override function.

The tool can be moved in the axis direction (+ or -) in which the machine is to be moved at the per-minute feedrate. The tool can be operated by an amount equivalent to the designated amount (incremental value) in the axis direction each time the jog switch is pressed. The machine can be moved in very small amounts by rotating the manual pulse generator. The G code command temporarily stops machine movement and sets the machine stand-by status for the time designated in the program. Diameter/Radius designation Positioning Positioning Unidirectional positioning Linear interpolation Safety and Energy saving Positioning/ Interpolation Linear/ Circular interpolation Circular interpolation (Center/Radius designation) Helical interpolation Hypothetical linear axis control Machining programs are stored in the CNC memory.

This function enables program editing such as correction, deletion and addition. This function enables one machining program to be created or edited while another program is running. 25 26 Standard Optional Selection Standard Optional Selection Class M system Structure of operation/ display panel C70 L system General explanation Class M system Spindle control functions Spindle digital I/F C70 L system General explanation The spindle rotation speed is determined in consideration of the override and gear ratio for the S command given in automatic operation or with manual numerical commands, and the spindle is rotated. This interface is used to connect the digital spindle (AC spindle motor and spindle drive unit). Color display (GOT) Select from among the product lines of GOTs (MITSUBISHI Graphic Operation Terminals).

Refer to the GOT catalogs for details. Absolute value/Incremental value setting Single-NC and multi-display unit switch Operation methods and functions When setting the data, the absolute/incremental setting can be selected from the menu. Using an Ethernet hub, one CNC module can be connected to and switched between up to eight displays. (Note that the max. number of connectable displays is limited depending on the machine operation panel specifications.) Using an Ethernet hub, one display can be connected to and switched between up to 64 CNC modules. (Note that the max. @@@@@The status of the program currently being executed is indicated. @@@@This is a system under which commands are assigned from the PLC. @@@@There are two methods for giving commands: G code and PLC.

The spindle rotation speed is clamped between max. rotation speed and min. rotation speed. @@The tool function is used to command the tool No. @@are also indicated. @@Four sets of M commands can be issued simultaneously in a block. @@@@The code data and start signals are output when an 8-digit number is assigned following the address code A, B or C -- whichever does not duplicate the axis name being used. These commands make it possible to control the axis movement by offsetting the position of the end point of the travel command by the amount set on the TOOL OFFSET screen. These commands function to provide tool radius compensation. Through a combination with the G command and D address assignment, they compensate the actual tool center path either inside or outside the programmed path by an amount equivalent to the tool radius.

Corresponding to the tool No., the tool nose is assumed to be a half circle of radius R, and compensation is made so that the half circle touches the programmed path. The nose radius compensation direction is automatically determined from the tool tip and the specified movement vector. Tool functions (T command) Miscellaneous functions Multiple M codes in 1 block Miscellaneous functions (M) M code independent output Input/Output functions and devices Design and Development With the GOT's CNC data input/output function, CNC data can be input/output from/to the memory card mounted in the GOT. (With GT16, input/output can be carried out via the front of the display.



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) Miscellaneous function finish 2nd miscellaneous 2nd miscellaneous functions functions (B) Tool length/ Tool position Tool length compensation Tool radius compensation Tool radius Tool compensation Tool nose radius compensation (G40/41/42) Automatic decision of nose radius compensation direction (G46/40) Number of tool offset sets 40 sets 80 sets Safety and Energy saving Tool offset amount 80 sets 200 sets Offset memory Tool shape/wear offset amount The standard for the machining center system is 40 sets. Note that the standard for the machining center system with 3-part systems will be up to 80 sets/part system, or with 4-part systems or more, up to 40 sets/part system. For the lathe system, up to 80 sets/part system regardless of the number of part systems. This function registers the tool shape offset and wear offset amounts. 27 28 Standard Optional Selection Standard Optional Selection Class M system C70 L system General explanation The machine coordinate system is used to express the prescribed positions (such as the tool change position and stroke end position) characteristic to the machine, and it is automatically set immediately upon completion of the first dog-type reference position return after the power has been turned ON or immediately after the power has been turned ON if the absolute position specifications apply.

By issuing a G code, the program coordinate system (zero point of program) can be changed on the workpiece coordinate system. After turning the power ON, even without executing the reference position return, the basic machine coordinate system and the workpiece coordinate system are set automatically. Class M system Optional block skip Program control Optional block skip addition C70 L system General explanation Machine coordinate system When "/" (slash code) is programmed at the head of a block, and the optional block skip input signal from the external source is turned ON for automatic operation, the block with the "/" code is skipped. When "/" (n:1 to 9)" is programmed at the head of a block, and the optional block skip input n signal from the external source is turned ON for automatic operation, the block with the "/n" code is skipped. The commands for automatic operation can be executed one block at a time (block stop) by turning ON the single block input signal. F code feed commands for automatic operation can be switched to the manual feedrate data of the machine operation board by turning ON the dry run input signal. When the machine lock input signal is set to ON, the CNC operations can be executed without actually moving the NC axis. When the "External input" signal or "Miscellaneous function lock" signal is turned ON, the output signals of M, S, T, and B (2nd miscellaneous function) will not be output to the PLC. This is useful when checking only travel commands in a program check. The program No.

of the program to be operated automatically can be designated and called up. Blocks can be indexed by setting the program No., sequence No. and block No. of the program to be operated automatically. With the input of the automatic operation start signal (change from ON to OFF), automatic operation of the program that was found by an operation search is started by the controller (or the halted program is restarted). Coordinate system setting Automatic coordinate system setting Workpiece coordinate system selection Workpiece coordinate system selection (6 sets) Coordinate system type and setting Extended workpiece coordinate system selection (48 sets) G54.1P1 to P48 (production site) Manufacturing technologies Single block Dry run When multiple workpieces with the same shape are to be machined, these commands enable the same shape to be machined by executing a single machining program in the coordinate system of each workpiece. Program test Machine lock External workpiece coordinate offset An external workpiece coordinate offset that serves as a reference for all the workpiece coordinate systems is available outside the workpiece coordinates. By setting the external workpiece coordinate offset, the external workpiece coordinate system can be shifted, and all the workpiece coordinate systems can be simultaneously shifted by an amount equivalent to the offset.

This function is for assigning a coordinate system on the workpiece coordinate system currently being selected. This enables the workpiece coordinate system to be changed temporarily. The coordinate system of the rotary axis ranges from 0 to $\pm 360^\circ$. Note that, however, it can be displayed from 0 to 359.999.

By issuing a G code, it is possible to specify the planes for the arc, tool radius compensation, coordinate rotation and other commands. Using the CNC monitor, the coordinate system (current position and workpiece coordinate position) can be set to "0" by screen operations. Using the CNC monitor, the position counter display can be changed to "0" by screen operations. This function enables the tool to be returned manually to the machine's default position (reference position). By commanding the G code during an automatic operation, the 1st reference position return is executed.

If an intermediate point is commanded, a positioning is made to the point at rapid traverse rate, then each axis returns to its 1st reference position. As in automatic 1st reference position return, by commanding the G code during an automatic operation, an axis returns to a certain point of the machine (2nd/3rd/4th reference position). By issuing a G code, a machining program, which has been prepared so that the tool starts off from the reference position and returns to the reference position, can be checked to see whether the tool will return properly to the reference position. With this function, a battery stores the relation of the actual machine position and the machine coordinate kept in the CNC even during the power OFF, and an automatic operation is enabled without executing a reference position return. Interrupt operation Operation support functions Program search/ start/ stop Miscellaneous function lock Program search Sequence number search Local coordinate system Coordinate system Coordinate system for rotary axis Plane selection Origin set/Origin cancel Counter set Manual reference position return Automatic operation start Maintenance NC reset Feed hold This function enables the controller to be reset. When the feed hold signal is set to ON during automatic operation, the machine feed is immediately decelerated and stopped. If the "Search & Start" signal is input when the memory mode is selected, the designated machining program is searched and executed from the beginning. Manual interrupt is a function that enables manual operations to be performed during automatic operation. The handle command can interrupt and be superimposed onto a command without suspending automatic operation, and the machine can be moved by rotating the manual pulse generator during automatic operation.



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